Watts Bar Nuclear Plant
Unit 2 Completion Project

Quarterly Update to the
Estimate to Complete
May 2012 - July 2012

Published October 2012

Nuclear
Construction

Table of Contents

Section 1 - Executive Summary

On April 26, 2012, the TVA Board of Directors approved a new Estimate to Complete (ETC) for Watts Bar Unit 2 (WBN2). As part of that process, the WBN2 team committed to performing a quarterly update to the ETC in order to maintain integrity of the estimate, as well as provide transparency into project performance.

The results of this review indicate that:

- The WBN2 project performance is consistent with the ETC plan approved by the TVA Board of Directors.
- The WBN2 project is within budget and meeting schedule.
- There are no new short-term risks identified that compromise project completion.

Project performance, as measured by Schedule Performance Index (SPI) and Cost Performance Index (CPI), is meeting target. Safety performance continues to be excellent. Quality performance has remained high as measured by Quality Control (QC) Acceptance Rate.

Project risks due to budget and schedule have not changed at this point. Some risk exists for future changes in projected cash flow due to deliberate measures to slow hiring and bring the project to full craft staffing. Regulatory and licensing issues remain the primary risks for the project; however, there is no change in short-term project risk due to licensing since Board approval in April 2012.

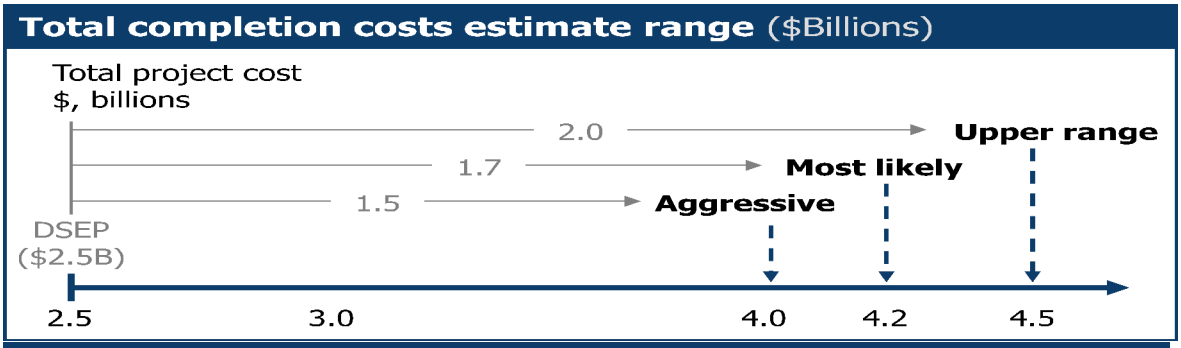
Section 2 - Overview

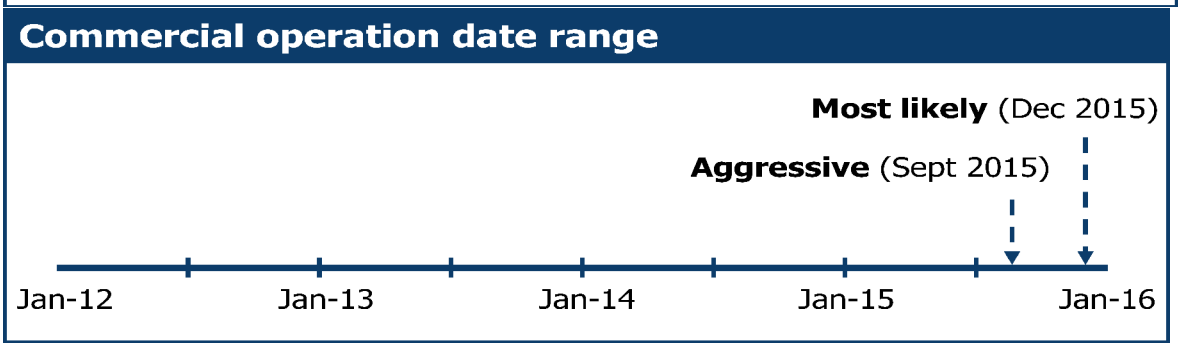
Background

The TVA Board of Directors approved the restart of construction for completion of WBN2 in August 2007. During the ensuing four years of project duration, WBN2 did not meet performance expectations for schedule or budget.

In August 2011, a new management team began being formed for WBN2. The new team performed a root cause analysis of the issues responsible for the performance problems, and in parallel, began to develop a new ETC for the project. Details of the cause analysis and the process used to develop the new ETC can be found in the *Executive Final Report on the Estimate to Complete*:
http://www.tva.com/power/nuclear/pdf/wattsbar2_executive_etc.pdf

The Board of Directors approved the new ETC for WBN2 on April 26, 2012. The project was approved based on a range of values for schedule and budget. The range of values was developed using the risks associated with meeting expectations. The approved budget and schedule is as follows:





Quarterly Performance Summary

As a part of the WBN2 improvement plan, a set of project metrics were developed and implemented to track performance and guide improvement. Below is the WBN2 Executive Dashboard, which is snapshot of current performance. The Executive Dashboard is comprised of a subset of the overall set of project metrics and is provided monthly to the Senior Vice President of Nuclear Construction, the TVA President and Chief Executive Officer, and the Board of Directors.

As can be seen from the chart at right, the project is meeting targets for most indicators.

Additional details on project performance are provided in following sections of this report.

WBN2 Executive Dashboard – July 2012

Performance Measure	MTD			YTD			FY Forecast		
	Budget	Actual	Variance	Budget	Actual	Variance	Budget	Forecast	Variance
WPSC- SPI - WBN (MTH)	1.00	1.01	1%	1.00	1.01	1%	1.00	1.01	1%
WPSC- CPI - WBN (MTH)	1.00	1.04	4%	1.00	1.03	3%	1.00	1.03	3%
Project SPI (weekly)	1.00	0.96	-4%	1.00	1.01	1%	1.00	1.01	1%
Project Direct Craft CPI (weekly)	1.00	1.09	9%	1.00	1.03	3%	1.00	1.03	3%
Current Schedule to ETC (Man Hrs) (weekly)	1.88 M	1.68 M	N/A	48.73 M	40.22 M	N/A	N/A	N/A	N/A
Earned Direct Job Hours vs. Weekly Plan (weekly)	56.265 K	56.861 K	1%	812.496 K	816.877 K	1%	N/A	N/A	N/A

Quarterly Highlights

In addition to overall performance meeting targets, the project achieved a number of milestones:

- The project exceeded 15 million work hours without a lost-time accident.
- The project Construction Permit extension request was submitted to the Nuclear Regulatory Commission (NRC) on May 17, 2012.
- The project successfully transitioned from a schedule focused on completing plant systems to a schedule that focused on completing the work in a given area. This approach provides for more efficiency in work performance by allowing work to be performed in bulk rather than a prescriptive sequence of activities that is not yet needed.
- "Tiger Teams" were employed to improve performance improvement in specific areas of concern. The top issues underway include:
  - Construction productivity
  - Work planning process
  - Refurbishment program
  - Documentation closure
  - Preventive maintenance and layup.
- The management team was strengthened by the addition of senior managers who are experienced in nuclear construction.
- The Employee Advisory Group (EAG) was re-established, and regular forums were held to address employee-generated issues.
- Improvements were made to the Corrective Action Program (CAP) to allow for more timely and efficient resolution of problems.
- Work package quality and timing were improved and metrics were put in place to ensure adequate focus on progress.
- A Change Control Board was instituted to provide senior management level approval of scope changes to the project and a structure for managing costs related to those changes.
- Executive meetings were held to review project performance, strengthen relationships, and develop any needed corrective action plans.
- Completed replacement of the containment spray heat exchanger, the installation of control rod drive mechanism cooler fans, and the refurbishment of the turbine-driven auxiliary feedwater pump.

Project Risks

Schedule Risk - SPI for the year-to-date is over 1.0 indicating that the work is being performed as expected. Additionally, the work hours of tasks reported as complete exceeded target. Therefore, schedule performance is such that no additional schedule risk is noted.

Budget Risk - CPI for the year-to-date is slightly over 1.0. Current performance projections indicate a year end CPI of 1.0 or better. The cost-related risks that were added to the project budget remain acceptable. Only about 5 percent of the project cost risk contingency has been realized. Craft staffing has been held below plan in order to ensure adequate planning is complete and productivity meets goals. Therefore, spending has been less than planned. An increase in project cash flow is possible assuming that today's underruns must be realized in the future. Currently, the project is not projecting an increase in cash flow.

Fukushima - WBN2 has submitted all required documents to the NRC. The final regulatory framework for the industry response has not yet been developed. In the interim, the project is developing a number of alternatives based on the regulatory framework to date. However, until the framework is complete by the NRC, the risk due to the response to the Fukushima event remains at the same level as in the ETC.

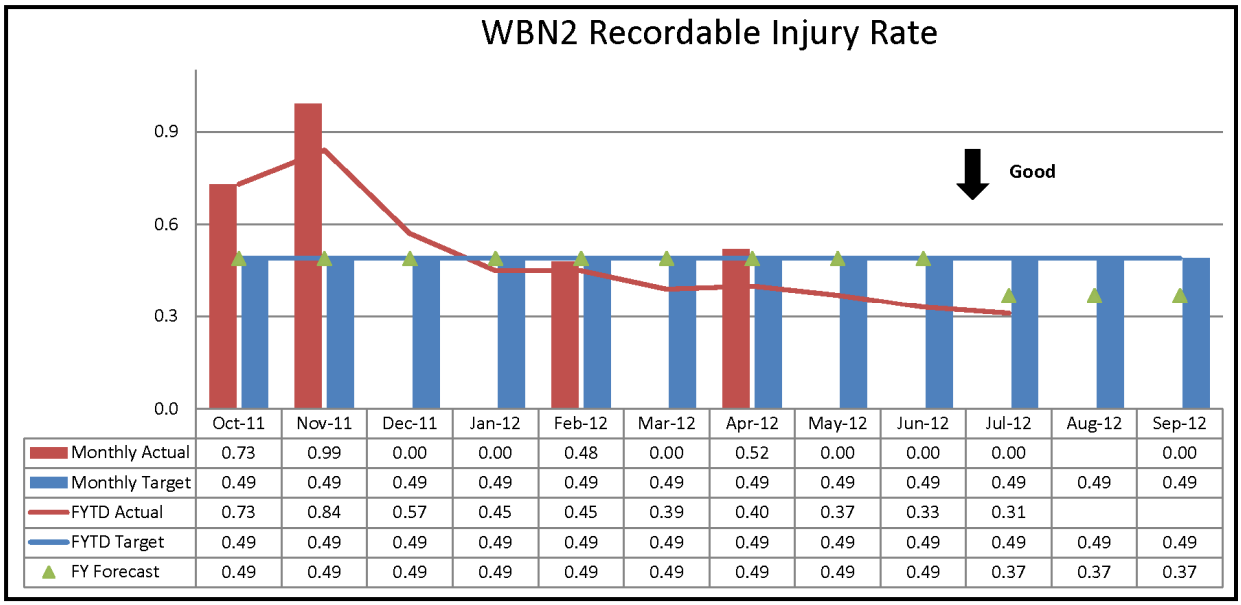
Licensing Risk - The NRC is drafting two new rules that could impact WBN2. The first is station black-out or loss of electrical power. The second is an industry issue with fuel cladding. Both of these issues are being closely followed by WBN2, and alternatives have been developed to deal with the issues should they arise.

In addition, the NRC recently issued a new order regarding on-site storage of used nuclear fuel. As a result of a court decision overturning the NRC's 2010 update of its "Waste Confidence Decision," the agency announced that it will not issue any final licenses until a determination is made on how to proceed in light of the court's decision. This decision has the potential to impact the final licensing process for the project, but it is not expected to impact the project in the short term. The indeterminate nature of this order must be considered an additional long-term risk for the WBN2 project. We continue to closely follow the issue, and we will work with the NRC to accommodate the strategy it employs to address the matter.

Section 3 - Quarterly ETC Results by Category

Safety

During this quarter, the project exceeded 15.3 million work hours without a lost-time accident. Additionally, the Recordable Incident Rate performance is better than goal as shown in the indicator below.



	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
Monthly Actual	0.73	0.99	0.00	0.00	0.48	0.00	0.52	0.00	0.00	0.00		0.00
Monthly Target	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
FYTD Actual	0.73	0.84	0.57	0.45	0.45	0.39	0.40	0.37	0.33	0.31		
FYTD Target	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
FY Forecast	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.37	0.37	0.37

The safety performance for WBN2 is excellent and is the result of a number of activities:

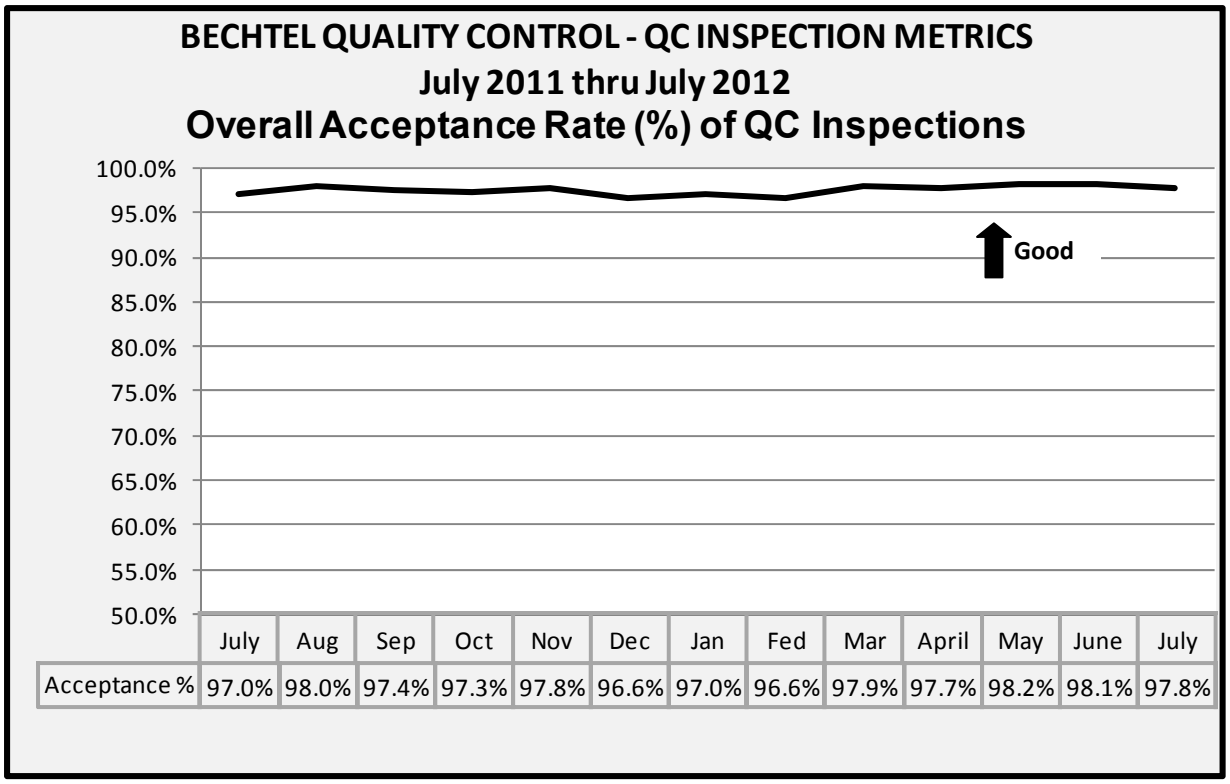
- Interventions - WBN2 workers intervene to protect fellow teammates from unsafe activities. The safety intervention program was developed by the Tri-lateral Safety Alliance. The interventions are tracked and consistently meet or exceed goal. Peer-to-peer coaching and interventions are powerful tools in preventing safety incidents.
- Use of pre-job briefs - Workers start the day by reviewing the work to be performed. Hazards are identified and steps are planned to ensure the work can be performed safely and without incident. Having a group discussion about the tasks and the safety steps ensures workers are engaged in performing work safely and that people can work together to make sure safe behaviors are demonstrated.
- Continued management focus - Management keeps safety as a core value. Expectations are clear, training is performed, and management performs observations of work to ensure safe practices are followed.

Focus areas for continued safety performance improvement include:

- Continuing support of co-worker interventions
- Elimination of workplace hazards
- Pre-job briefs on lifting techniques and body positioning.

Quality

Quality performance at WBN2 has remained high throughout the transition of management, as well as the implementation of a new project plan. This is an indicator of positive worker training, as well as the level of involvement by the QC workers in day-to-day activities of the project. The primary measure of project construction quality is the Quality Control Acceptance rate. It measures the percentage of work that has passed the QC inspection process during installation.



	July	Aug	Sep	Oct	Nov	Dec	Jan	Fed	Mar	April	May	June	July
Acceptance %	97.0%	98.0%	97.4%	97.3%	97.8%	96.6%	97.0%	96.6%	97.9%	97.7%	98.2%	98.1%	97.8%

Recent key activities in Quality Assurance (QA) include:

- Certificate of Authorization surveys by the American Society of Mechanical Engineers (ASME) were successfully completed, resulting in a three-year extension of stamp certification.
- The first in a series of audits to re-validate the Bechtel QA performance of contract requirements in the execution of 10 CFR 50 Appendix B was completed. The Bechtel audit and surveillance program adequately evaluated design control and procurement activities conducted on the project.
- An independent audit of TVA QA by industry peers from the Vogtle construction project was completed last quarter with no audit findings. Recommendations provided by the team are under evaluation.

During this period, QA also issued a quarterly report. The report summarized the results of QA assessments in:

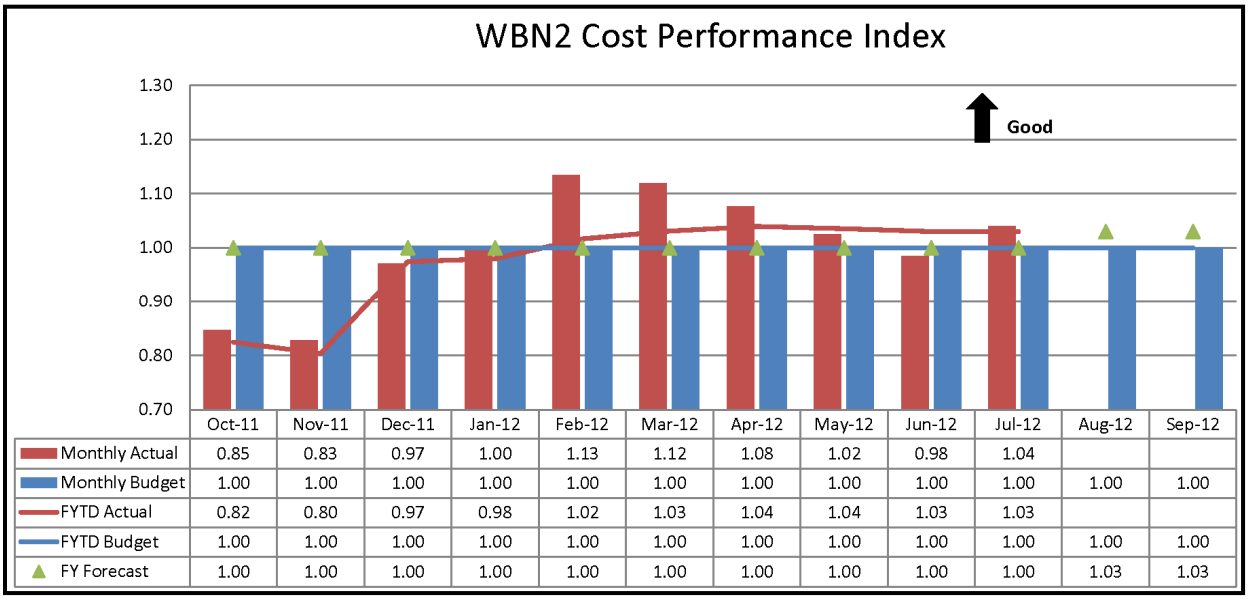
- Construction completion
- Refurbishment
- CAP

In the QA quarterly report, two areas of concern were identified that warrant continued management attention. They are:

- Use of vendor information, primarily in the area of work order planning. Recent QA oversight identified the absence of vendor manual recommendations in preventative maintenance documents. Corrective action has been taken, and QA will continue to monitor to ensure actions have been effective.
- Loose fasteners continue to be identified on some completed work in areas such as flexible conduit fittings, one-hole clamp supports, and wedge bolt nuts. An extent of cause review is in progress and increased construction supervision involvement of field completion activities has been initiated in the interim.

Cost

Cost performance met expectations for the quarter. An important measure of cost performance is the CPI - an indicator of how efficiently work is being performed against the plan. CPI measures whether workers are able to complete tasks within the work hours originally planned for the task when the ETC was developed. Therefore, CPI is a good measure of the project ability to complete activities within the project budget. CPI performance is as indicated below:



	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
Monthly Actual	0.85	0.83	0.97	1.00	1.13	1.12	1.08	1.02	0.98	1.04		
Monthly Budget	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FYTD Actual	0.82	0.80	0.97	0.98	1.02	1.03	1.04	1.04	1.03	1.03		
FYTD Budget	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FY Forecast	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.03

CPI for the year-to-date is tracking at 1.03, indicating tasks are being performed for the estimates assumed in the ETC.

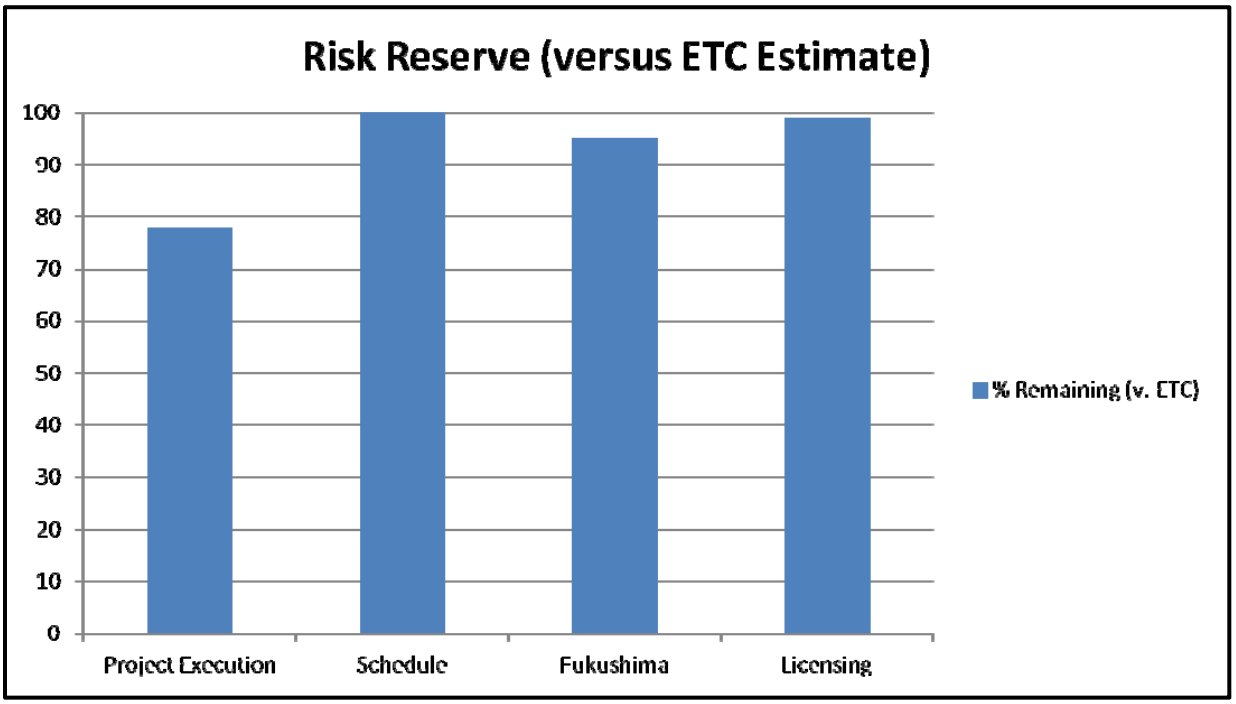
The project is focused on maintaining performance in CPI and is taking the following actions:

- Increasing the amount of time supervisors are in the field by eliminating other duties from their jobs
- Assigning Design Engineers to the planning group to improve workability of work packages
- Assigning additional Field Engineers to support the craft and minimize delays

A goal of the Quarterly ETC Update is to understand how the project is tracking against risk contingency.

When the ETC was developed, project risks were identified and categorized. Plans were put in place to be able to deal with those risks. Each of those risks has a budget assigned in the ETC. The amount of funding used on those risk projects indicates whether the ETC project risk assumptions are valid or whether the risks are likely to cause a cost overrun.

The chart below depicts the current status of the risk reserve. Some of the risk reserve has been allocated to projects. The overall risk reserve is currently at 94 percent. This is well within the range expected and planned in the ETC. This analysis, therefore, concludes that allocation of risk reserves does not currently indicate a risk to the overall cost of the project as compared to the ETC.



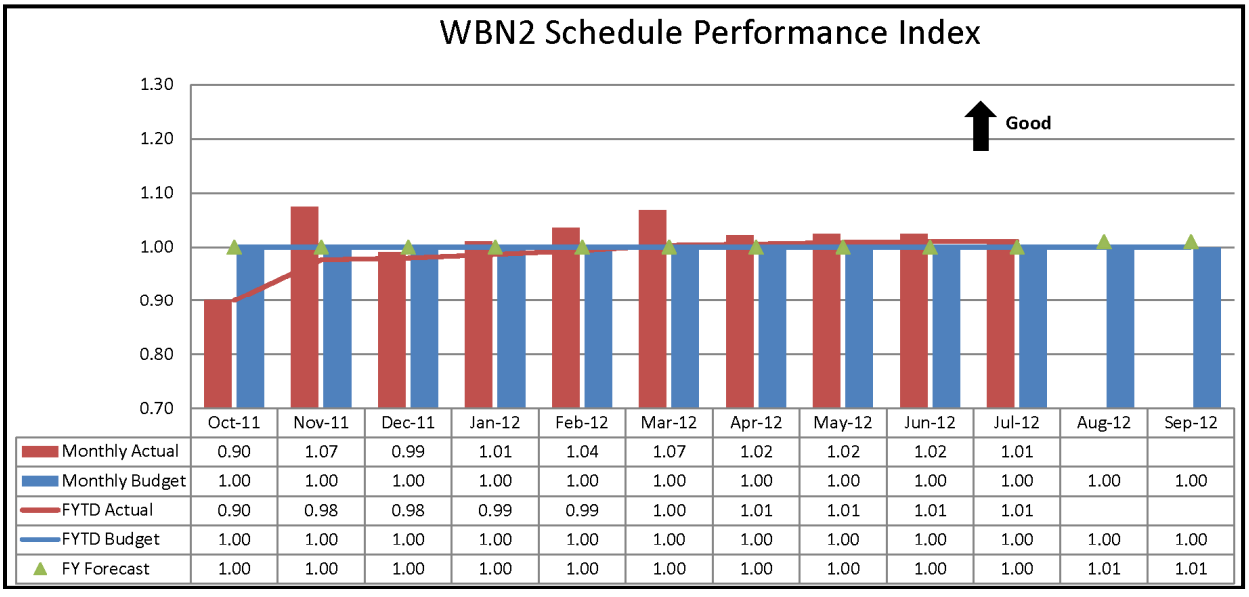
During the quarter, project craft staffing did not meet plan. This was a deliberate decision based on a number of factors:

- It is necessary to have an adequate backlog of work planning documents prepared to keep the craft working on tasks.
- There must be availability of skilled craft in a given area of expertise.
- The project must have the ability to reach productivity goals at existing staffing levels prior to increasing staff.

The project considered these factors and determined that it was not feasible to fully staff to planned levels. As a result, cost underruns were experienced. There is a risk that these cost underruns will need to be spent in later quarters, thus increasing needed cash flow. While this cash flow projection is a risk, it is not yet certain as to whether a shift in cost to later years will be necessary. The realization of risk is currently favorable and will likely make a positive impact to the project cost. It should be noted that the project has not identified an increase in the overall project budget; rather it is a potential risk of the timing of the expenses.

Schedule

Schedule performance met expectations for the quarter. An important measure of schedule performance is the SPI - an indicator of the effectiveness of executing the schedule. SPI is measured by comparing the hours completed for a task versus the hours scheduled for a task and tells whether the schedule is being worked as planned. Therefore, SPI is a good measure of the project's ability to complete construction within the specified timeframe. SPI performance is as indicated below:



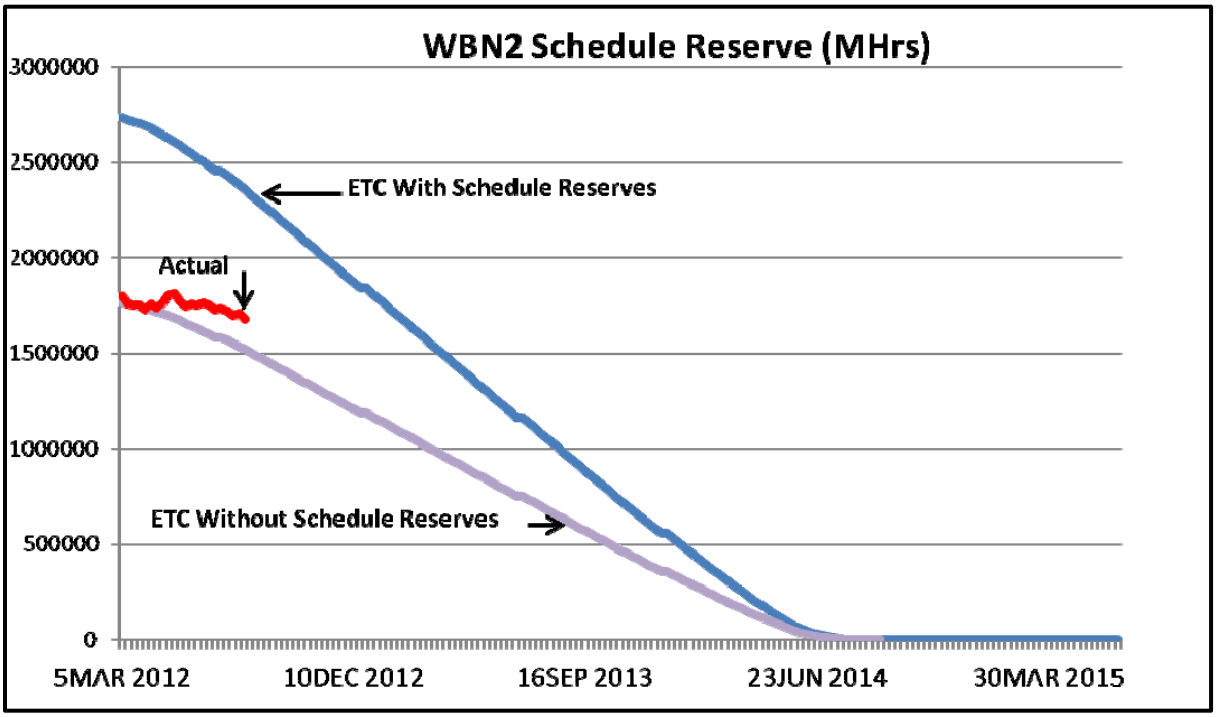
	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
Monthly Actual	0.90	1.07	0.99	1.01	1.04	1.07	1.02	1.02	1.02	1.01		
Monthly Budget	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FYTD Actual	0.90	0.98	0.98	0.99	0.99	1.00	1.01	1.01	1.01	1.01		
FYTD Budget	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FY Forecast	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.01

SPI has been consistently tracking near or above the goal of 1.0 since the first of the calendar year. Based on performance to date, SPI is expected to achieve or exceed the target of 1.0 at the end of the fiscal year.

The project is focused on keeping schedule performance at or above target. Actions to improve schedule performance include:

- Incrementally increasing schedule loading to higher craft staffing levels
- Maintaining an aggressive schedule target
- Holding regular management challenge sessions to remove barriers and ensure accountability.

An important element of the quarterly ETC is to understand how the project is progressing toward schedule completion compared to the estimates in the ETC. When the schedule was developed, not all work orders had been planned and scheduled. Also, with a megaproject of this size and complexity, estimates must be made to deal with equipment that does not perform as planned or additions to the scope of the work that must be accommodated. Therefore, the ETC contains estimates for each of these categories that could impact the project schedule, and ultimately, the project completion date. The project keeps track of the baseline work hours without reserves and makes a comparison against the total work hours in the ETC. The purpose of tracking this metric is to make sure that the project is not exceeding the overall ETC estimate. This metric is reflected below:



Currently, the schedule is on track to meet project completion milestones. Challenges in the future involve a smooth transition from bulk work to the system completion window.

Section 4 - Project Oversight

Nuclear Construction Review Board (NCRB)

The Nuclear Construction Review Board (NCRB) is a group of industry experts that routinely reviews project performance and provides their insight to the Senior Vice President of Nuclear Construction. The NCRB is independent of WBN2 management to ensure that reviews are not biased and that project performance is on track. The latest NCRB provided a number of insights, among those are:

- Cost and schedule deviations must be monitored and evaluated. Scope changes and contingency funding must be authorized. This action is complete.
- WBN2 should benchmark other organizations that have addressed performance problems on mega-construction projects to compare performance metrics. This action is planned for completion in September.
- Evaluate the project risks identified by the NCRB using the project risk process to evaluate and rank risks for inclusion in the project scope. Provide for contingency as appropriate. This action is complete.

TVA Office of Inspector General (OIG)

During this quarter, the project received the final report from the TVA Office of Inspector General (OIG) regarding its comprehensive project audit. The OIG's report was consistent with the root cause analysis performed by the project and offered insights into project elements such as project planning, project execution, transparency, and organizational health. WBN2 has developed an action plan to address the OIG findings.

Project Assurance

The Project Assurance (PA) group is an organization within NC that reports directly to the Senior Vice President of Nuclear Construction. It is independent of the WBN2 project organization. PA has several full-time members whose jobs are to continually assess all facets of project performance and provide those reports to the Senior Vice President of Nuclear Construction. During this quarter, the PA group was established and staffed and began performing assessments. Findings of the PA group include the following:

- Work order walkdowns are not part of scheduled activities; therefore, the walkdowns may not have the time and resources allocated to ensure they are adequately performed.
- The WBN2 team needs to assign clear responsibility to ensure weekly auditing of quantity reporting.

Management is implementing plans to address these items, with progress to completion being tracked by the PA group.

Section 5 - Project Organizational Health

Engagement and Alignment

With a new management team, Nuclear Construction developed a new mission and vision. In order to aid in achieving that mission, an Engagement and Alignment Strategy was developed. The purpose of the strategy is to support efforts necessary for Nuclear Construction to achieve its vision, improve performance, and strengthen organizational health. The following are some of the actions in the strategy that have been completed:

- Re-invigorated the EAG - A new management sponsor was designated and new members were selected to represent employees. The group has been active and maintains a web site that tracks actions, meeting minutes, and other group activities.
- Implemented a communications plan - A comprehensive communications plan was implemented based on organizational objectives and employee feedback from the Organizational Health Index survey. The plan uses a variety of media, including regular communications from the Senior Vice President of Nuclear Construction to keep workers informed of project status and issues.
- Completed a gap assessment to INPO Standards - The project recently completed an assessment against the standards outlined in Institute of Nuclear Power Operations 09-007, Principles of Excellence in Nuclear Construction. This assessment and the gaps identified will form the basis of additional action plans that will be instrumental in helping to achieve long-term excellence for the project.

Tiger Teams

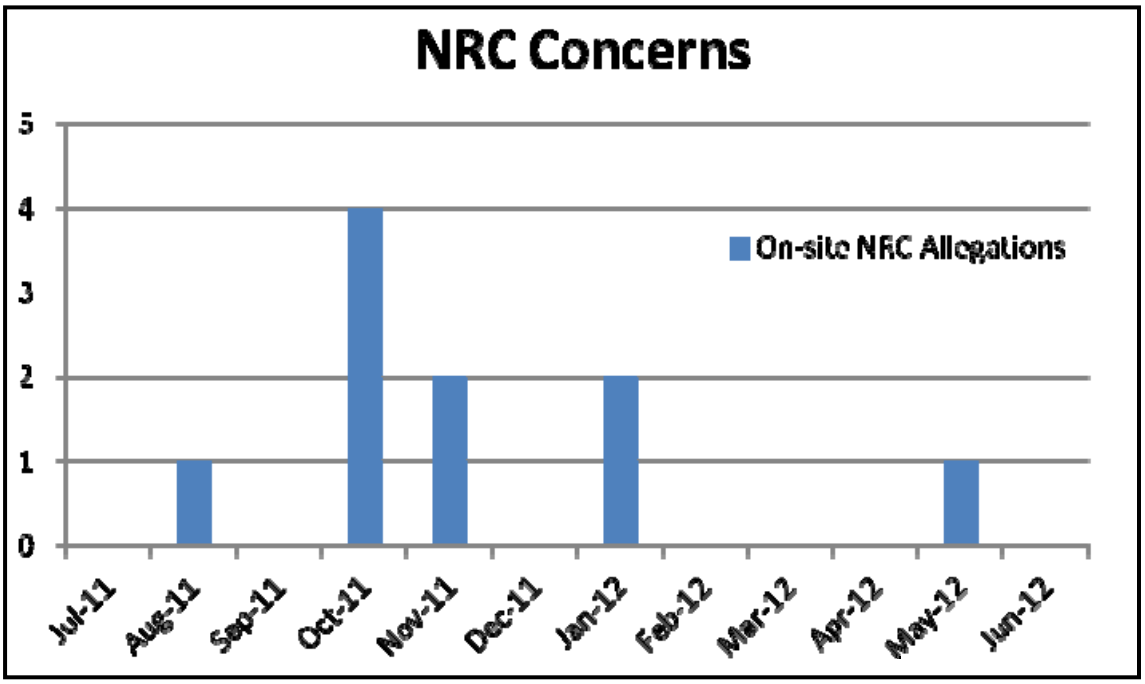
The Engagement and Alignment Strategy is designed to support efforts necessary for the organization to achieve its vision, improve performance, and strengthen organizational health. In addition to that strategy, the project has undertaken a number of additional improvement plans. By using employee input, corrective action documents, and project metrics, areas in need of improvement are identified. These improvement opportunities are prioritized by the senior leadership team members. Action teams are assigned to determine causes of problems, develop action plans, and drive action plans to completion. The project calls these teams “Tiger Teams.” The teams drive improvement and also encourage employee participation in problem solving. Examples of top “Tiger Teams” include CAP Improvements, Construction Productivity Improvements, and Work Planning Process and Improvements.

Safety Culture

The construction of a nuclear power plant involves recognizing and adhering to many special and unique requirements. Because nuclear safety is our over-riding priority, the project must maintain an open environment that allows and encourages individuals to express concerns about nuclear safety and quality. Management encourages employees to bring safety concerns directly to the management team for action. Employees also have additional avenues to express concerns that are independent of management through the Employee Concerns Program (ECP), the TVA OIG, and the NRC.

A measure of organizational health is the number and the nature of concerns raised outside the management team via these independent avenues. Employee concerns to the ECP spiked between June and November of 2011 but have declined since then.

Regarding concerns raised to the NRC, while the overall numbers are low, the trend is similar to the ECP trend, as shown below.



The trends in ECP and NRC allegations are indications of an improving safety culture. While it is a positive trend, it is also important to note that employees take advantage of the opportunity to use both the ECP and NRC to raise concerns. A strong nuclear safety culture encourages all employees to take advantage of any avenue they may deem appropriate to raise nuclear safety concerns.

Section 6 - Going Forward

For the upcoming quarter, the project focus will remain on completing bulk work in construction and to improve the timing and quality of work documents. In addition, new challenges must also be addressed in order to complete the project as scheduled. The top five focus areas for the upcoming quarter are:

- **Fukushima and Hydrology** - The regulatory impacts of Fukushima and related hydrology issues will be significant for WBN2. A plan is under development that will encompass the multiple elements that comprise this issue. The plan requires a coordinated effort among a variety of organizations within TVA. As such, it is an example of the teamwork involved in completing the project. By the end of the next quarter, we expect the plan to be finalized and implementation underway.
- **Documentation Closure** - Construction of a nuclear power plant requires a significant amount of documentation to show that work is completed to meet all regulatory and design requirements. Over time, the completion of construction work has outpaced the performance of the final documentation verification and the creation of an acceptable document package. The project has developed a plan of attack to close the gap between construction completion and document closure. During the next quarter, there will be a new focus on implementing that plan, staffing required positions, and using metrics that will guide performance improvement.
- **Transition to System Completion** - Construction is currently using a bulk work approach for project completion. However, the project must ultimately finish plant systems to allow for testing and turnover to Operations. The WBN2 schedule was built with a specific transition period. The purpose of the transition period is to complete activities that will allow bulk work to end, and then to schedule and track work to support system completion. Activities to support that transition in the next quarter include mechanical and electrical activity logic.
  - Mechanical activity logic is completed and tied to system completion. The mechanical focus is on maintaining the logic current with new activity input.
  - Electrical activity logic is underway. By September, activities will be tied to system completion.
- **Unit 1/Unit 2 Integration** - Transition from single unit operation of Watts Bar Unit 1 to operation of a two-unit site requires an integrated approach with both the existing operating staff and the construction staff. An organization dedicated to developing a detailed plan has begun with the selection of a new Vice President of WBN2 Start-up. During the upcoming quarter, this new organization will be developing detailed plans, staffing key positions, and implementing the plan using an integrated, two-unit approach.
- **Licensing Strategy Implementation** - A WBN2 Licensing Strategy has been developed that will provide structure to the myriad of regulatory and licensing issues that must be addressed prior to operation of WBN2. Included in this strategy are action plans to improve the quality and timely completion of licensing documents. This regulatory interface is critical to the completion of the project and will be a major focus in the upcoming quarter.